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ARMY SCIENCE BOARD
FINAL REPORT

1989 SUMMER STUDY ON INTERNATIONAL COOPERATION AND DATA EXCHANGE TO ENHANCE THE ARMY'S TECHNOLOGY BASE

August 1990

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EXECUTIVE SUMMARY

The first major objective of this study was to specify how the Army's international cooperative research, development and acquisition (RDA) program could more effectively enhance the Army's Technology base. The study resulted in six major issues and recommendations:

(1) Policy and implementation need strengthening; the study recommends that the Secretary of the Army (SA) obtain Office of the Secretary of Defense (OSD) guidance and integrate it into a comprehensive and integrated planning and management framework with appropriate delegation of authority to match responsibility and accountability.

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(2) The bilateral technology working group concept can energize cooperative R&D programs; the study recommends that AMC use the bilateral working group concept with selected countries.

(3) People exchange programs offer opportunities for the technology base; the study recommends that the Assistant Secretary of the Army Research, Development and Acquisition, ASA(RDA), take the lead in developing a more attractive scientist and engineer exchange program supportive of Army technology base requirements and objectives using resources available to the Army (government, academia, industry.)

(4) There are technology areas that offer significant potential benefits; the study recommends that ASA(RDA) direct an evaluation of identified regional opportunities and develop them on a priority basis.

(5) Non-DoD activities in international cooperation are underutilized; the study recommends that the Department of the Army (DA) take advantage of experience and expertise of non-DoD activities in international cooperation.

(6) Close Army-industry cooperation is a key to success in international cooperative programs; the study recommends that DA formalize a process for increasing industry participation in policy formulation, program planning, the memorandum of Understanding (MOU) process, and removing barriers to cooperation.

The second major objective was to identify a better framework for more efficient leveraging of the Army's international cooperative RDA. The recommended framework uses a top-down systematic approach, starting with a strategy that consecutively results in policy, implementing directives, plans, programs, and program evaluation. The strategy must be proactive and responsive in posture; selective and flexible in application; country-specific within both regional and global contexts; partnership-premised; oriented to leverage resources (financial, personnel, technology); and based on a long-term perspective. The strategy must not only develop facilitating mechanisms, it must remove the many attitudinal (e.g., "not invented here") and institutional (e.g., intellectual property rights) barriers to international cooperation. Existing policies and directives that are complicated or in conflict must be rationalized and simplified; new policies and implementing directives must be coherent and consistent. Plans to enhance international cooperative R&D must be integrated into the existing planning, programming and budgeting system. The Technology Base Master Plan would provide an excellent framework for such international cooperative R&D planning.

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(2) The bilateral technology working group concept can energize cooperative R&D programs; the study recommends that the Army Materiel Command (AMC) use the bilateral working group concept with selected countries.

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ARMY SCIENCE BOARD (ASE) SUMMER STUDY ON INTERNATIONAL COOPERATION
AND DATA EXCHANGE TO ENHANCE THE ARMY'S TECHNOLOGY BASE

OBJECTIVES:

- o Identify how the Army's international cooperative research and development program can more effectively enhance the Army's Technology Base.
- o Identify a better framework for more efficient leveraging of the Army's international cooperative research, development and acquisition (RDA) program.

TERMS OF REFERENCE:

- o Examine current means and programs for international cooperative research and development.
- o Evaluate U.S./France working group as a prototype.
- o Assess current impact on labs and centers (including Nunn program).
- o Consider barriers to international cooperation and how to remove them.
- o Recommend how to better integrate international cooperative research and development into the Army technology base.

STUDY APPROACH:

- o A systems approach was used to translate TOR into assessment process.
- o Visits were made to Europe, Far East, Canada, Israel, Brazil.
- o Surveys were taken of U.S. industry (10) and other Government agencies (25).
- o Briefings were heard from Army, OSD, other foreign governments and industry (60).
- o The Army Science Board assembled and reviewed data base reports.
- o The Army Science Board performed group analysis and synthesis.

IDENTIFICATION OF ISSUES: To conduct the Summer Study, the Army Science Board selected a systems approach methodology called quality function deployment. The process enabled the study group to decompose the terms of reference which led to directing the group's activities to four assessment areas. The group then identified six major issues to address in the study. The findings and recommendations that pertain to each issue follow:

ISSUE 1: POLICY AND IMPLEMENTATION NEED STRENGTHENING

FINDINGS:

o Conflicting policy guidance makes it difficult for the Army to execute its international RDA Cooperative Program.

o Current level of commitment is inadequate to achieve goals of 10% RDTE&A by FY1994 and 25% by FY2000.

RECOMMENDATION:

o SA obtain consistent guidance on policy from OSD, and DA integrate this guidance into a planning and management framework that delegates appropriate authority with responsibility and accountability

DETAILED FINDINGS:

The current conflicting policy guidance makes it difficult for the Army to execute its International Cooperative Research, Development and Acquisition (RDA) program. (Note: international cooperative RDA activities span 6.1, 6.2, 6.3A, 6.3B, 6.4 and production activities while "tech base" activities span 6.1, 6.2, 6.3A.

Different sources: International cooperative RDA is complicated by various policy initiatives and activities of Congress, the Department of Commerce, the Department of State, the Department of Defense, et cetera, that are often in conflict. The lack of direction from the Office of the Secretary of Defense (OSD) on how to interpret and respond to these different policies makes it difficult for Services and subordinate commands to interpret and appropriately respond to initiatives and activities from other agencies, bureaus, committees, and departments. A recent example was the high level of national controversy and debate that the approval of the Memorandum of Understanding (MOU) of the FSX coproduction agreement between the U.S. and Japan generated. It is important to note that Japan is funding 100 percent of the FSX program cost. The fear was that transferring the FSX technology (which is a mature technology) to Japan would have a negative impact on the competitiveness of the U.S. commercial aviation industry.

Documentation not current: International cooperative RDA for the Army is further complicated by a plethora of DoD directives, DoD instructions, and DA regulations that were enacted under previous administrations in very different political environments. These documents have not been updated to reflect current policy. Although policy on the releasibility of both classified and unclassified information to foreign nations has existed for a long time, supporting documents have not been updated to reflect the current international environment.

Different interpretations: The a priori determination of releasibility is difficult since final determination at OSD levels is often subject to widely ranging individual interpretation. The determination becomes more difficult as the technology moves from well-defined systems toward applied research. In addition, usable guidelines virtually do not exist for basic research. Criteria for technology transfer could be based upon intelligence assessments that compare U.S. technology to that either available within the hostile nations or available to the hostile nations from sources other than the U.S. (If the technology is already available to hostile nations, then there is no point in protecting the technology from the hostile nation.) ASB has found no evidence that such intelligence assessments were being developed or used.

The conflicting policy guidance, either because it is from different sources, different times, or subject to different interpretation, makes it difficult to formalize, rationalize, and systematize the processes of international cooperative RDA (market research, analysis, planning, programming, resource allocation, negotiation, management, implementation, evaluation, and program revision). Without DoD directives to use as prototypes, it is difficult to formalize Army Regulations (AR) and directives: AR 70-41 has been in draft form, awaiting final approval for over one year now. It is critical that the management process be rationalized by ensuring that levels of responsibility and accountability are matched by appropriate levels of authority. Most importantly, the processes have not been systematized: the Planning, Programming and Budgeting System (PPBS) does not now explicitly account for international cooperative RDA activity. This makes it difficult to facilitate the preparation and implementation of mutually beneficial and equitable International Cooperative RDA agreements. (An example of this is that the Memorandum of Understanding (MOU) internal staffing and approval process takes too long.)

The absence of clear international goals for countries and regions (especially for regions outside the North Atlantic Treaty Organization (NATO) is creating implementation problems for the Army. Similar to the policy level, where there are many different policymakers with different agendas setting policy, there are many different planners with different missions setting goals and objectives. Historically, there have been more policies, directives, and laws supporting international cooperative RDA with NATO than with other regional alliances or countries: this is to be expected given our longer and closer association with NATO countries than with some other non-NATO countries (for example, Korea). The absence

of clear goals for other regions/countries results in implementation problems: it is difficult to target programs without goals; it is difficult to allocate resources without program prioritization; it is difficult to evaluate success in achieving goals if the goal is undetermined and unknown.

Technology development programs are at present, most often and most easily evaluated by level of activity (e.g., how many meetings, data exchange agreements (DEAs), etc.) rather than by level of contribution to the U.S. defense posture, U.S. technology base, or U.S. economy. These current measures of effectiveness are useful, but since they are quantitative and not qualitative in nature, they do not adequately support an umbrella investment strategy that prioritizes programs and allocates resources accordingly. In order to realize the intent of cooperative programs to benefit the U.S. defense posture, technology base, and economic standing, it is imperative that qualitative measures of value be developed and used to formulate and evaluate cooperative agreements. In an era of increasingly constrained resources, the wise allocation of resources to high-priority programs is critical to the ultimate success and viability of international cooperative RDA. Also, in an era of increasing competition for these increasingly constrained resources, it will become more critical for joint technology programs to quantify net savings and benefits to the U.S. from sharing costs and risks with other countries.

The current level of Army commitment to international cooperative research, development, test and evaluation (RDT&E) (as demonstrated by organizational structure, resources, and delegated authority) is inadequate to achieve the Defense Guidance and DA goals that by FY 1994 10 percent of the RDT&E Program Objective Memorandum (POM) be directed at international cooperative RDT&E and that by FY 2000, 25 percent of the RDT&E POM be directed at international cooperative RDT&E. So, assuming that in FY 2000, the RDT&E POM for DA is $5 billion (B), and that 25 percent of this $5B is matched by our partners, then we will have gained approximately $1.25B from our partners, thereby leveraging the overall funding to $6.25B. The net gain will possibly be less than $1.25B. It is possible that the incremental costs associated with the international cooperative RDT&E programs will offset an as yet undetermined portion of this $1.25B contribution from our partners, resulting in a net gain less than $1.2 B. It is also possible that the net gain will be more than $1.25B. As of mid-February 1989, the burden-sharing ratios for Nunn amendment projects with signed MOUs showed that while the U.S. government absorbed 31 percent of the MOUs' cost, our allies absorbed 69 percent. Although it is impossible to say what the net gain will be, it is possible to affirm that there will be a net gain to the United States. In any case, these 10- and 25-percent levels represent significant increases from the 3-percent level that is currently allocated to international cooperative RDT&E. In order to achieve these aggressive growth goals, it will be necessary to have an adequate infrastructure (efficient organizational structure that facilitates industrial and academic participation, adequate staffing, sufficient and stable funding, and appropriate levels of authority) to achieve these goals.

Because of the absence of clear DoD implementation directives, commitment to international cooperation is presently service-interpreted and personality-driven. As a result, commitment to international cooperation varies by service and by individual (discussions with representatives of other countries often included statements that they perceived the Army to be more committed to international cooperative RDA than other services). Different components of the DoD international community do not always coordinate their programs: as an example, Army personnel at the DA, Major Commands (MACOMs), and field levels do not always coordinate activities with sister services. This is not an indictment of the Army: the lack of inter-service, inter-agency coordination seems to be endemic to the system as a whole. The unfortunate outcome is that the United State's approach to international cooperation is viewed as disorganized by other countries, although some representatives of other countries (e.g., France and Korea) stated that they perceive the Army to be more organized than its sister services.

Another finding that points to a low level of commitment to international cooperative RDA is that there is no Senior Executive Service (SES) official or General Officer (GO) on the Army staff whose time and energy is fully dedicated to being the international cooperative RDA focal point, thereby serving as the central source for critical documents, information, and guidance, and overseeing the integration of policies, strategies, and resources in a decentralized and fragmented organizational structure. This ASB finding for the Army is congruent with the Office of Technology Assessment (OTA) finding for DoD that "First, OSD lacks either the ability or the will to exercise power over the Services. And second, there is no one individual or office that serves as a focal point and coordination center for the technology base programs of the component organizations." (Holding the Edge: Maintaining the Defense Technology Base, page 20.)

DETAILED RECOMMENDATIONS:

The first recommendation is that the Secretary of the Army obtain consistent and explicit guidance on policy from OSD and that DA integrate this guidance into an international cooperative RDA planning and management process that should (a) include international policy in Tech Base Master Plans (TBMP) and Force Modernization Plans; (b) conform with specific guidelines in National Security Review (NSR-11); (c) standardize international cooperative RDA standard operating procedures (SOPs) and reporting requirements among international partners; and (d) clean up previously issued DoD policy and implementation directives and instructions and Army regulations by either revising them to reflect current DoD and/or DA policy, or superseding them with new documents that reflect current DoD and/or DA policy. However, if the Secretary of the Army cannot obtain consistent and explicit DoD policy guidance, he should direct DA to move forward with its own policy formulation and planning process. Unfortunately, the Army and the nation do not have the luxury of operating in a static environment where windows of technological (and economic) opportunity stay open forever: the Army and the nation are now operating in a dynamic, multi-polar global arena that

requires that the United States and its allies and friends move quickly to take full advantage of technological opportunities.

DA should work with other components of DoD in the development of global strategies and regional/country goals and objectives. The global strategies should conform with the overarching strategy which is investment-based (capitalize on other people's money), technology-based (capitalize on other people's technology), and force modernization-based (Conventional Force Enhancement: CFE). This approach, which enhances the U.S.'s return on investment (ROI), will result in a parallel enhancement of our partners' ROI. For all these agreements, a win-win approach that will result in mutual and equitable benefits for all participants is critical to the long-term success and viability of international cooperative RDA.

Some possible analyses to identify strategies and objectives include (a) augmenting case-by-case analyses with analyses that take a broader point of view; (b) developing scenarios of shifting country alliances, and emerging or anticipated regional alliances that could have an impact on international cooperative agreements and the tech base; (c) conducting end-game scenarios that highlight long-term impact of emerging or postulated regional alliances (e.g., European Economic Community (EEC) 1992, Pacific Rim); (d) identifying processes for technology assessment of foreign capabilities; or (e) instigating a study in the intelligence community that will analyze how the technology-specific release guidance (e.g., Critical Technologies Plan) must be augmented by country-specific and region-specific security guidance.

A study could be conducted to analyze costs and benefits of automating the processing of information exchange. The methods of information gathering and analysis could be based on state-of-the-art information technology that can gather, process, and transmit data in the most appropriate, efficient, and timely way: e.g., automated decision support systems, satellite teleconferencing, electronic blackboards, electronic mail, etc.

Following analysis, the OSD should set up an umbrella MOU framework for selected regions/countries.

The DoD should also give some consideration to the risks and rewards associated with expanding the standardization group concept to a "store-front" worldwide network of "international cooperation shops," staffed by representatives of DoD and industry/ academia.

If DA can develop a qualitative and analytical methodology by which the contributions of technology cooperation agreements (both on a stand-alone basis, and in the aggregate) can be evaluated, then it will be able to quantify its return on investment and fine-tune its investment strategy.

DA should strengthen its commitment to and organization of international cooperative RDA by strong advocacy, continuous stable resources, and organizational reform. Three possible advocacy programs that could be considered follow: (a) Consider developing a DA position paper on how to best communicate with Congress about international cooperation. One position that could be taken would be to actively defend executive powers by espousing the point of view in the Executive Branch that Congress should give DoD and DA managers wide latitude to construct programs within agreed overall funding levels. (b) Consider developing a strong advocacy program that could be applied internally to ensure organizational support and externally to ensure industry awareness and participation. For example, the Army could use the U.S. Army Laboratory Command (LABCOM) Technology Symposium (which showcases LABCOM's broad spectrum of research and technology projects in a series of displays and demonstrations) as a prototype to emphasize the Army's own priorities and demonstrate the Army's priorities to our allies and friends in industry and academia, both at home and abroad. (c) Continue with annual meetings of Army leadership (e.g., AMC Conference on International Armaments Cooperation).

DA should strengthen its commitment to international cooperative RDA by ensuring that an appropriate level of resources is allocated. In the financial resources area, the relative costs and benefits of extending the two-year budgeting system (that were espoused by both the Packard Commission and the OTA study on the U.S. technological edge) to at least a five-year budget for R&D should be evaluated. It is possible that an even longer-term financial commitment is preferable, so the analysis of the five-year budget system could be augmented by analyses of 10, 15, and 20-year budget systems. For example, the Netherlands has a 20-year budget.

DA should also strengthen its commitment to and organization of international cooperative RDA by ensuring that the personnel resources and organizational structure are strategically aligned with international cooperation's goals and objectives in compliance with NSR-11. Possible actions include (a) developing mechanisms to coordinate various staffs working on different aspects of international cooperative RDA; (b) developing an organizational chart reflecting all international positions, and then correcting staffing deficiencies and overlaps; (c) evaluating the feasibility of assigning a staff with the primary responsibility of overseeing international program coordination and integration across the entire Army laboratory community, spanning the Army Materiel Command, the Corps of Engineers, the Army Research Institute, and the U.S. Army Medical Research and Development Command; or (d) conducting a possible test of a modified personnel system that is more conducive to providing incentives and rewards to scientists and technologists in the laboratory environment and thereby attracting and retaining top-quality scientists and engineers. This possible test could adapt the China Lake, Naval Ocean Systems Center, and the Nation Institute of Standards and Technology (NIST) experiments to one of the more prominent laboratories (e.g., Ballistics Research Laboratory). These experiments all experienced various forms and levels of success: they are briefly reviewed in chapter 5 of the Office of Technology Assessment report on Holding the Edge: Maintaining the Defense Technology Base.

ISSUE 2: THE BILATERAL TECHNOLOGY WORKING GROUP CONCEPT CAN ENERGIZE COOPERATIVE R&D PROGRAMS

FINDINGS:

o U.S. and French Technology Working Group appears successful. Positive indicators observed include: improved DEA activity, strong management oversight, more effective program expansion, productive lines of communication and steady progress.

o Technology Working Group effectiveness today is the result of the work of key individuals. An institutionalized format, with strong operating guidelines and principles, is needed to expand technology exchange as well as provide continuity.

RECOMMENDATIONS:

o AMC initiate action to selectively expand the bilateral technology working group concept with close attention to lessons learned from the U.S. and France experience.

o AMC develop a more structured and institutionalized program for the conduct of bilateral technology working groups.

DETAILED FINDINGS:

One of the five terms of reference (TOR) given this study was to evaluate the viability of the "working group" concept and the vitality of the bilateral Technology Working Group (TWG) between the United States and France. The "working group" concept has been an integral part of our cooperative R&D program with France. It originated in 1982 as an umbrella management concept and has grown to include seven subgroups, the latest one was formed in 1987.

A subgroup of the ASB study team attended the fourth meeting of the U.S. and France TWG at White Sands, NM, on March 30-31, 1989. This meeting, ancillary reading materials, and further discussions with both the American and French participants and senior level U.S. R&D managers served as the basis for the findings and recommendations that follow.

The TWG concept has had a positive impact on an increasingly effective cooperative R&D relationship with France. The most notable contributions of the TWG are (1) providing close, responsive oversight of ongoing programs (for example, to increase cooperation in concept exploration and technology development through the data exchange program with France); (2) facilitating effective communication and efficient

coordination (for example, coordinating plans and schedules for data exchange project officials with ongoing and proposed technology base initiatives between the U.S. and France); and (3) generating new initiatives (for example, systematically identifying and prioritizing cooperative R&D projects that emerge from the data exchange dialogue). All these contributions enhance the productivity and growth of the two national R&D efforts.

Today, the principal activity of the TWG is the Data Exchange Agreement (DEA) program. The American Technical Project Officer (TPO) and his French counterpart are charged with establishing their mutual goals and objectives for each DEA. Serious shortcomings, which are acknowledged by both the Americans and the French, include the lack of (1) defined measures of effectiveness (MOE) (i.e., what makes a program "good"?); (2) a mechanism to monitor the status (i.e., what stage is the DEA at in its life-cycle?); (3) a methodology to quantify the varying levels of contribution of the working group concept at different stages in its life cycle (i.e., if it's good, how good is it?); (4) a formalized review of past or present projects; and (5) a system to incorporate "lessons learned" from such a review. The correction of these shortcomings has been given a high priority by the TWG management.

The full group meets semi-annually at alternating sites in the two countries. The GO level executives and their key staff members meet at a quarterly interval between the semi-annual TWG sessions. The frequent interaction and the participation of GOs and senior-level executives have been critical in maintaining the high level of interest, attention, and energy of TWG members. The frequent interaction, participation of senior level managers, and location at alternate meeting sites are three critical and dynamic preconditions that enhance awareness, understanding, credibility, trust, and open exchange -- the essential ingredients of success for an international cooperative R&D program.

The two senior-ranking representatives for the U.S. and France were extremely active and knowledgeable participants at the semi-annual meeting. The exercise of their on-the-spot decision authority was instrumental in resolving issues and in providing positive, clear guidance for future activity. The interaction of top decision-makers has been a major factor that has contributed to the success of the TWG.

As is often the case in cooperative ventures, the personalities of the key individuals are the most important factors in determining whether a program will succeed or fail. Selecting the right individual is very important but a good selection process needs to be augmented by a viable management structure that relieves excessive dependence upon the skills or talents of few individuals. Program stability and growth requires the development of a program structure that provides very specific guidelines on how to achieve mutually agreed upon goals and objectives. A sound program structure cannot replace a talented program manager, but it can have a multiplier effect by making it easier for the manager to perform and produce at a higher level.

During its visits to other foreign countries, the ASB explored the potential application of the bilateral TWG concept with those responsible for cooperative R&D. The prospect of improved coordination and control and the feasibility of bringing a wide range of cooperative R&D programs under a single manager were two strong pluses that caused the concept to be consistently received with interest and enthusiasm. Selective expansion of the concept to other countries should only be done after appropriate review and analysis, but Canada and Israel are candidates worthy of early consideration.

Finally, the TWG concept is adaptable to a full range of cooperative R&D ventures with selected partners. Emphasizing DEA oversight is the first step toward a better coordinated and disciplined bilateral relationship.

DETAILED RECOMMENDATIONS:

Based upon a positive assessment of the U.S./France Technology Working Group, the ASB recommends that AMC selectively expand the application of the TWG concept to other nations. The new partners should be carefully selected, giving considerable weight to the past experience and future potential of mutually beneficial international cooperative R&D activity. Past experience in the U.S./France TWG should be carefully reviewed and analyzed; "lessons learned" should be applied to new TWGs.

The value of every international cooperative R&D program to the overall U.S. Army RDA program must be periodically evaluated. In order to do this, key program objectives must be established; qualitative and quantitative measures of effectiveness (MOE) must be developed; a methodology to efficiently summarize and present the responses of the many agencies involved in program review and analysis must be implemented. It is recommended that AMC give high priority to establishing a system for developing MOE and evaluating the contribution of each international cooperative R&D program.

It is recommended that AMC institutionalize the process of international cooperative R&D by developing the minimum number of principles and guidelines necessary to 1) ensure compliance with OSD and Army at the policy level and (2) provide flexibility to capitalize on opportunities at the operational level.

In concert with the third recommendation, AMC should continue to invest in the development of the institutional environment, infrastructure, and resources that will (1) result in a highly productive international cooperative R&D exchange program and (2) thereby strengthen its technology base.

ISSUE 3: PEOPLE EXCHANGE PROGRAMS OFFER MAJOR OPPORTUNITIES FOR THE TECHNOLOGY BASE

FINDINGS:

o Foreign nations have broad and strong interest in expanding exchange programs and expect only reasonable quid-pro-quo, but barriers exist.

oo Lack of understanding of the foreign partner environment.

oo Disincentives for both participants and their managers.

oo No organized preparation and training for U.S. participants.

oo Knowledge gained by U.S. participants not well utilized upon return.

RECOMMENDATION:

o ASARDA take the lead in developing a more attractive S&E exchange program supportive of Army Technology Base requirements and objectives using resources available to the Army (government, academia and industry.)

DETAILED FINDINGS:

The successful development of technology base cooperative programs is dependent upon relationships between counterparts; the quality of results is directly related to the capability and dedication of these individuals. Participants can be drawn from staffs of Army laboratories and centers; faculty and staff of Army Centers of Excellence; and possibly university faculty (on sabbatical leave) who are supported by Army 6.1 funds.

A summary of current personnel exchange program shows that approximately 90 percent of the Scientist and Engineer Exchange Program (SEEP) and Memorandum of Understanding (MOU) participants are foreigners working in the U.S. The nations visited during the course of this study expressed a strong interest and desire to increase the number of exchange programs and a willingness to bring U.S. scientists and engineers (S&E) into their laboratories and centers (without unreasonable expectations that the U.S. transfer technology to them). AMC confirms this finding.

A major barrier to the development of international cooperative R&D ventures is U.S. participants' lack of knowledge of how potential partners conceptualize, structure, and operate their system. Often the

U.S. participant neither speaks the language nor understands the culture of the other nation. These shortcomings can be removed by having participants attend a language school and participate in courses specifically oriented toward learning about the culture of the foreign nation. The language can be learned at Defense Schools; the cultural understanding can be obtained by attending courses either at the Foreign Service Institute that is operated by the U.S. State Department or at commercial institutions.

The Army criteria for career advancement of scientists contain no provisions for recognizing or rewarding the successful completion of an exchange program foreign assignment. Usually, participants must disrupt and relocate their families for a short (one year) tour of duty. They may suffer financial loss. Since the participants are highly capable and productive, they may often have to leave their own research effort with little or no assurance that they will be able to return to specific endeavors upon their return. They will be out of the mainstream of their laboratories' work. They can expect to receive little or no recognition, publicity, or reward for their work while abroad, and the prospect that their overseas experience will enhance their career is poor. Rather, it is more likely to set their careers back--their position may have been taken by another or deleted. In Scientist and Engineer Exchange Programs, significant disincentives for U.S. participants form a barrier to the development of international cooperative R&D exchange activities.

There are no provisions to compensate participants' managers for the up-front financial and personnel investment in exchange programs. The participants' managers do not receive additional funds to finance incremental expenses associated with the overseas assignment. Participants' managers must (1) reallocate (divert) financial resources from programs in their existing budget and (2) replace personnel resources assigned to overseas assignments in order to ensure continuity of the scientific effort and to protect the participants' positions from being cut. Significant disincentives for U.S. managers to participate in SEEPs also form a barrier to the development of international cooperative R&D exchange activities.

There are no provisions to capture and capitalize upon knowledge gained by participants in exchange programs. The exchange program participants are sometimes assigned to entirely new areas of work upon completion of their overseas assignment. Since their hard-won knowledge is not well used, it is effectively lost to the Army. For example, there is no systematic process to take into account the benefits accrued. This attests to the lack of overall program planning. Program planning can start with the TBMP and its Emerging Technology List. An accurate assessment of foreign capabilities will allow the U.S. to selectively identify and target specific opportunities for personnel exchange programs that have a high potential for transferring needed technology to the U.S. Army. Work in the targeted area could be enhanced by bringing foreign nationals to work in the sponsoring laboratory during the participants' absence. Program planning for a long-term effort would provide for continuation of the work upon the participants' return. More mutual and equitable participation would facilitate and accelerate the transfer of needed technology.

DETAILED RECOMMENDATIONS:

Based upon the Emerging Technologies List in the TBMP and an accurate assessment of foreign nation capabilities, the Office of the Assistant Secretary of the Army for Research, Development and Acquisition (OASA(RDA)) should establish a set of objectives that identify specific foreign R&D opportunities for the development of international cooperative R&D exchange programs. At the same time, criteria should be developed to measure the expected return on investment (ROI); later, the same criteria should be used to determine the level of success of ongoing and completed exchange programs.

All potential sources for qualified participants available to the Army should be used, including Army laboratories and centers, Army Centers of Excellence, and university faculty whose continuing research efforts are supported by Army 6.1 funds.

New policies should be established by ASARDA, both to remove existing barriers and disincentives and to create new incentives for U.S. participants. The Navy and Air Force approaches to scientist and engineer exchanges should be viewed as a source of already in-place and working policies and procedures. U.S. participants should be schooled in the language, culture, infrastructure, and operating systems of the foreign host nation, either by attending existing courses (given by the Foreign Service Institute, Defense Schools, commercial institutions, etc.) or new courses that might be established by the Army. Provisions should be made for exchanges to last as long as two years; relocation costs and in-country living expenses should be fully reimbursed. Immediate recognition should be given for the work done on the foreign assignment. The participant should be encouraged to publish in the refereed journals, and his contribution should be publicized. Cash incentive awards are appropriate and should be made available. One of the most important criteria for assessing the level of personnel performance and contribution should be the level of participation in "people exchange programs."

An exchange program should be viewed as an integral part of a long-term effort to inculcate new and important technology base information into the Army; it should be planned as such. The plan should provide for the research and development work to continue long after the exchange is completed. If such a long-term effort is inappropriate, then the priority of the work to the Army was probably not high in the first place.

Since the cost associated with a well-planned and executed people exchange program is beyond the means of most program managers, these high-priority programs will remain underfunded unless additional funds are allocated. The Army Acquisition Executive (AAE) should allocate sufficient funds to augment those currently available to the program managers to ensure program viability and success.

ISSUE 4: THERE ARE TECHNOLOGY AREAS THAT OFFER SIGNIFICANT POTENTIAL BENEFIT

FINDINGS:

- o The worldwide spectrum of opportunities recognized by the DoD critical technology plan spans the Army Technology Base Investment Strategy for emerging technologies.
- o Examples of specific opportunities were identified in each of the regions visited.
- o Many Nunn cooperative R&D programs are already underway but there has been no activity in the 6.1/6.2 technology base programs.

RECOMMENDATIONS:

- o OASA(RDA) direct an evaluation of the identified opportunities and recommend appropriate action.
- o OASA(RDA) take appropriate action to permit technology base (6.1/6.2) programs to be developed under the Nunn program.

DETAILED FINDINGS:

The ASB was asked to identify key technologies offering significant return on investment on a global basis. Because the worldwide spectrum of technological opportunities spans the Army technology base, it was deemed appropriate to narrow the focus to those specific geographic regions and countries that were visited by a member of the ASB. Those opportunities with the greatest potential are listed below.

- o Europe: Codevelopment/coproduction of Allied light helicopters.
- o Israel: Sensors/signal processing, medical, chemical-biological-toxin defense/biotechnology.
- o Japan: Robotics, electronics, missiles, chemical defense/biotechnology, vehicles, materials.
- o Canada: Space and human engineering technologies.

The Nunn Amendment to the FY1986 Defense Authorization Act made $200M available for NATO Cooperative R&D projects. Funds provided were to be used for cooperative projects involving joint participation by the U.S. and one or more NATO members. Program funding has continued at a slightly reduced level. The

U.S. funds must be spent in the U.S. In later years, funding was extended to non-NATO cooperative R&D. The current statutes limit the application of the funds to coproduction-development and coproduction-production projects. The statutes do not permit use of this funding source for technology base efforts. Since coproduction-development and coproduction-production ventures are usually large dollar programs and the allied partner must sign a separate MOU for each project and commit to providing a significant amount of the funding (not to exceed 50 percent), the so called Nunn programs have fallen below expectations by several million dollars each year. The implementation of the statute by OSD does not allow for expenditures to the limit authorized. As technology-based program needs to grow in number and importance, the amendment of the statutes to establish authority for technology base effort and the set-aside of a fraction (perhaps 25 percent) of the Nunn Cooperative R&D funding for international cooperative technology-base projects would seem to be fully consistent with and supportive of the original Congressional intent. Discussions with a variety of agencies experienced in implementing the Nunn program and Congressional staff supported the finding that such an amendment would be consistent with Congressional intent.

Warfighting, especially in the Third World, in preparation for or during either extended special operations or low-intensity conflicts, will be rate or tempo limited by two issues even before trauma and triage. Endemic infectious disease and chemical/ biological toxin detection/defense/decontamination will affect about one-third of all fighting forces. Current international medical research in the developing countries in South America, Asia, and Africa are targeted against the most important issues of identifying rapid tests and more effective treatments for malaria and vector infectious disease; viral and sexually transmitted disease pathogenesis and vaccine evaluation; and real-world experience with diseases endemic to regions of possible conflict. Europe, Japan, and Israel offer additional unique advantages since they possess scientists and laboratory programs having potential for enhancement in certain specific biotechnologies, wherein leading-edge research in chemical/biological-toxin detection, vaccine production, and nonmedical materials production is very advanced over that found in the United States. Examples include research on viral replication (France), micro-electronics applied to biosensors based on antibody-antigen interactions (Japan), and near real-time process control for fermentation--a technology that will "enable" vaccine production strategies of the next three decades (Israel and Japan). Small United States financial and personnel investments in dollars and in Army scientist participation could bring access to highly developed industry-academic networks and early research results in these foreign countries.

DETAILED RECOMMENDATIONS:

The ASB recommends that the identified technological opportunities be incorporated into the TBMP and Force Modernization Plans of the Army, subject to favorable feasibility analysis.

It is recommended that OASA(RDA) take the lead in the Army effort to obtain legislative action to amend the Nunn program authority to set aside approximately 25 percent of the annual funding for technology base joint programs.

The Army should more fully leverage its investment in medical research and development. The Army TBMP identifies leveraging of other governmental organization resources so as to gain back a multiple of U.S. expenditures (e.g., medical R&D contract dollars from the two dozen or so efforts of Medical Research and Development Command (MRDC) personnel permanent change of station (PCS) at the nine overseas medical laboratories) to solve key Army requirements or fill gaps in one of the identified OSD critical technologies (e.g., biotechnology, vaccine process technology, or chemical/biological warfare detection.)

Specifically, OASA(RDA) should consider incorporation of the ongoing MRDC Data Exchange Agreements (DEAs) in Israel on chemical defense, infectious disease, vaccine development, and laser injury into a separate medical working group. Existing DEAs, information gathering activities, and biannual joint symposia and medical researchers obtain excellent returns for the limited dollars spent. However, a more formalized and stable (personnel consistent) organization to support and enhance the current liaison missions at the large research institutions (e.g., MRDC liaison at the Weizmann Institute) may add important opportunities to further leverage the investment with no incremental cost. Efficiencies could be realized by using existing U.S. Army scientific talent to coordinate otherwise separate DEAs and MOUs which nonetheless all support the key substantive medical program needs mentioned above. Actions should be requested by OASA(RDA) from the Deputy Surgeon General for Medical Research, Development, Test and Evaluation (MRDT&E), who is already identified in the Army TBMP as the DoD Executive Agent for joint Service agreements and the Joint Technology Coordinating Group of the Armed Services Biomedical Research, Evaluation and Management (ASBREM) Committee. And since the Israeli research community is highly networked into private sector companies with major subsidiaries in the U.S., Nunn Amendment program resources should be accessed.

ISSUE 5: NON-DOD ACTIVITIES IN INTERNATIONAL COOPERATION ARE UNDERUTILIZED

FINDINGS:

- o Many active and productive programs exist.
- o Significant cooperative agreement formulation experience exists.
- o Significant supporting experience and knowledge exist.

RECOMMENDATION:

- o DA take advantage of experiences and expertise from non-DoD activities in international cooperation.

DETAILED FINDINGS:

Non-DoD federal agencies, pursuing their missions, have leveraged their R&D resources in collaboration with their counterparts in other countries. Four federal agencies, each with different missions, were chosen for study: the National Science Foundation (NSF), the Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA), and the Department of Energy (DOE). While their R&D activities span 6.1 to 6.4, in each case the bulk of the cooperative opportunities are aimed at 6.1 and 6.2. If they move beyond that level of maturity, different agreements are struck.

The cooperative partners involve countries and regions that span the globe and range from developing to developed nations and consortia.

The development of cooperative programs is a complex process from many perspectives. It would be an error to assume that these programs were easy to set up or that new ones can be created without problems. First, the complexity of overall governmental systems which simultaneously motivate and regulate international cooperation is a major influence in agreement formulation. There is much prior experience (especially with EEC and Japan) in surmounting the conflicting objectives and responsibilities of different countries and their international cooperative R&D systems.

Second, there are both budgetary and statutory constraints. The new emphasis on intellectual property rights (IPR) (which can be viewed as a statutory constraint) is delaying the initiation of some new programs. (The IPR language dictated by the Department of Commerce for the U.S./Japan Science and Technology (S&T) Agreement is now the template for many new bilaterals. However, none of the four agencies queried cited it as a "show-stopper", perhaps because their programs are primarily 6.1 and 6.2 funded.) The DOE recently completed an agreement with the government-owned Japanese Power Reactor and Nuclear Fuels Development Corporation which incorporates the Department of Commerce's latest requirements for IPR protection.

DOE and NSF specifically mentioned either maintenance of staff offices or full-time representatives outside the continental United States (OCONUS) and foreign language training as contributing factors to successful programs.

State governments seeking to enhance economic growth and protect their industrial base, have facilitated international cooperative agreements. In addition to establishing cooperative programs with Israel and France, several State governments have set up offices in Japan to attract business and to expand cultural exchange. States have also sponsored visiting teams of political, business, and education leaders, as well as scientists and engineers to develop mutual beneficial activities with other countries. A major objective of these activities is to identify local businesses that could effect technology transfer.

These efforts on the part of state governments have required significant investments. First, there is the money that has been invested by the foreign nation/industry in researching the technology. Second, there is the money that the state has invested and will invest in bringing the technology to the U.S. Third, there is the money that the U.S. private sector has invested and will invest in transferring the technology to our shores.

- Universities seeking mechanisms to stay on the cutting edge of research, have made agreements with research institutions in other countries.

The Army has made a substantial investment over the years in its extramural research programs and in the people who have managed these programs, but this investment has not been fully leveraged. These programs have produced people with technical expertise in areas where international programs have existed in the past, exist now, or are proposed for the future--people who are associated with the Army but who are not full-time federal employees.

The Army is maintaining its long-standing association with U.S. universities through a variety of programs. In addition to Reserve Officer Training Corps (ROTC) scholarships, the Army supports graduate students on fellowships at University Research Initiative Centers (URI) and as research assistants. It supports individual faculty researchers at its multidisciplinary research Centers of Excellence and at U.S. universities in general.

Ten technological areas (manufacturing science, E-O/signal processing, advanced propulsion, geosciences, reaction kinetics, intelligent control, high-frequency micro-electronics, dynamic materials, biotechnology, and advanced construction) were supported with an allocation of $45 million in the Army in FY 1989 budget.

There are also 23 Centers of Excellence, established within the past decade, covering nine broad areas of technology (computers and computation, rotary-wing aircraft, optics, materials and advanced construction, electronics, propulsion and kinetics of energetic materials, geosciences, biotechnology, and mathematics.)

Finally, there are individual faculty, supported in one-year or multi-year contracts, engaged in research that builds the Army's technology base. Estimates of the pool of talent involved give figures greater than 1000 people. These Army-sponsored individuals possess talents and skills in areas of interest. Some of their professional expertise lies in areas of interest to existing international working groups or DEAs. Little, if any, use has been made of these people and their pooled talent as resources in furthering the Army's international cooperative R&D programs. These people and the technical knowledge and expertise they have gained could be more fully accessed and used.

DETAILED RECOMMENDATIONS:

The first major recommendation is that AMC must develop strategies and programs to more fully leverage the substantial investments (by the Army and non-DoD agencies) in international cooperative R&D programs. To do this, AMC must do the following:

(a) Survey and evaluate international cooperative R&D programs conducted by all non-DoD agencies for potential value to the Army.

(b) Develop a broad range of programs to leverage its existing capital and resource base by utilizing OPM (other people's money and resources). Were the Army to pursue this potential opportunity, it could significantly leverage its increasingly limited asset base.

(c) Task the proponents of the emerging technologies to establish joint ventures or consortia with selected ongoing non-DoD high-potential programs.

The second major recommendation is that the Army develop strategies and programs to more fully access and use the existing experience and knowledge base in international cooperation. Three possible strategies and programs are the following:

(a) First, faculty at Army Centers of Excellence should assist in evaluation of foreign technology as participants in Technology Working Groups, Data Exchange Agreements, Intergovernmental Personnel Agreements (IPAs), and personnel exchanges.

(b) Second, Army-sponsored individuals in universities and Centers of Excellence possessing important talents and skills in areas of critical national interest have gained technical knowledge and expertise that should be more fully accessed and used as resources in furthering the Army's international cooperative R&D programs. If issues of academic freedom are addressed properly, some of these people could serve as consultants for short-term surveys; be supported for their sabbatical year as researchers

overseas collaborating with peers to develop technology that the Army can use once they return to the U.S.; serve as participants in Working Group and DEA technical teams; or be brought into the Army community on two-year IPAs to take part in Army personnel exchange. The result would be a closer coupling of the work performed at URIs, etc., and closer coordination of the Army Research Office (ARO) and its London branch, the European Research Office (ERO) with the Working Group/DEA activities. The Army would thereby more fully leverage the substantial investment it has made over the years in extramural research programs by involving the people who have managed these programs.

(c) Third, the Army should consider and use previous experience of Federal and State governments in developing more effective international cooperative agreements aimed at 6.1 and 6.2, regional negotiation methods, and conflict-resolution techniques. Some of the experiences gained by State governments, universities, and non-DoD federal agencies in producing international cooperative R&D agreements (and perhaps even the agreements themselves) should be studied and possibly adapted by the Army in its own international cooperative R&D programs. These non-DoD participants' knowledge and expertise concerning other countries' objectives, operational constraints, and successful negotiation and conflict resolution methods, and their prior experiences in surmounting the conflicting objectives and responsibilities of this complex system should be systematically studied, and basic negotiation strategies for specific regional/country thrusts should be developed. As an example, DA (like DOE and NSF) should consider (1) setting up a network of either maintenance or full-time representatives abroad and (2) requiring foreign language training as a prerequisite to participation in international "people exchange programs."

ISSUE 6: CLOSE ARMY-INDUSTRY COOPERATION IS A KEY TO SUCCESS IN INTERNATIONAL COOPERATIVE PROGRAMS

FINDINGS:

o Industry-to-industry teaming is most effective and should be actively facilitated and promoted and promoted by the Army.

o Industry participation and commitment to international programs is impeded by a lack of stability and clarity in international program policy and practices.

o Asymmetries in government and industry structure, acquisition practices, and data rights are significant obstacles to cooperation.

RECOMMENDATION:

o DA formalize a process for increasing industry participation in policy formulation, program planning, the MOU process, and removing barriers to cooperation.

DETAILED FINDINGS:

Cooperative technology efforts must ultimately be measured by their productivity, as embodied in force modernization. The translation of technology into systems must be done by industry; direct industry-to-industry teaming is generally considered the most effective, and in many cases, the only viable approach to translating technology into systems.

U.S. international cooperation, especially that which is based on close Army-industry cooperation, suffers from inconsistencies between policies and practices, as these programs are envisioned by the Congress and executed by the Department of Commerce, and DoD. In addition, effort and responsibility are currently fragmented within DA. This lack of coherence impedes both industry and allied government cooperative activities.

There is generally a much closer relationship between the indigenous industries and the Defense agencies of our allies in NATO and the Pacific Rim than exists in the U.S. This asymmetry (between the U.S. allies and the United States) of the differing levels of industry participation in policy formulation and the different perspectives on intellectual property rights must be recognized and proactively addressed to assure effective and balanced implementation of cooperative programs. Both domestic and foreign industry reports that U.S. practices in the area of data rights inhibit technology cooperation, particularly in the area of dual-use technologies. This is in contravention to the national objective (and technology transfer law) encouraging technology transfer
a quick, easy, and convenient access to advanced technologies of both Defense and commercial origin. There have also been reports that current security practices often inhibit timely and potentially productive cooperation with our allies and frequently restrict access to technologies that are already available to the Warsaw Pact.

DETAILED RECOMMENDATIONS:

The ASB recommends that the Army build on the positive initiatives and actions enhancing the U.S. international defense posture and strengthening close Army-industry cooperation and industry-to-industry teaming that were the result of the AMC-sponsored "Conference on Improving U.S. Industry's Role in International Armaments Cooperation" (January 1989). It is also recommended that the Army take the

positive step of establishing an American Defense Preparedness Association (ADPA)-sponsored industry committee to work cooperatively with the Army on a continuing basis.

It is recommended that serious consideration be given to consolidating the Army's international activities in a single office at AMC since AMC has an established infrastructure for developing and implementing international programs that could possibly be used to integrate the currently fragmented Army organizational structure for international programs. Such an office could serve as a well-defined focal point for Army policy on international cooperative R&D programs and activities.

It is recommended that the Army investigate and review domestic and foreign industry claims that U.S. practices in the area of data rights inhibit technology cooperation, particularly in the area of dual-use technologies, and determine whether current practices fulfill the national objective (and technology transfer law) encouraging access to advanced technologies of both Defense and commercial origin. Consideration should also be given to revising security practices which inhibit timely and potentially productive cooperation with our allies.

KEY RECOMMENDATIONS

The key recommendations of this study address each of the six issues identified based on the first major study objective - to identify how the Army's international cooperative RDA program could more effectively enhance the Army's technology base. The key recommendations are:

- SA should obtain OSD guidance and integrate it into a comprehensive and integrated planning and management framework with appropriate delegation of authority with responsibility and accountability.

- AMC should use bilateral working group concept with selected countries.

- OASA(RDA) should take the lead in developing a more attractive S&E exchange program supportive of Army technology base requirements and objectives using resources available to the Army (government, academia, and industry.)

- OASA(RDA) should direct an evaluation of identified regional opportunities and develop them on a priority basis.

- DA should take advantage of experiences and expertise from non-DoD activities in international cooperation.

o DA should formalize a process for increasing industry participation in policy formulation, program planning, and the MOU process to remove barriers to cooperation.

The weight of the key recommendations are tabulated in the following chart:

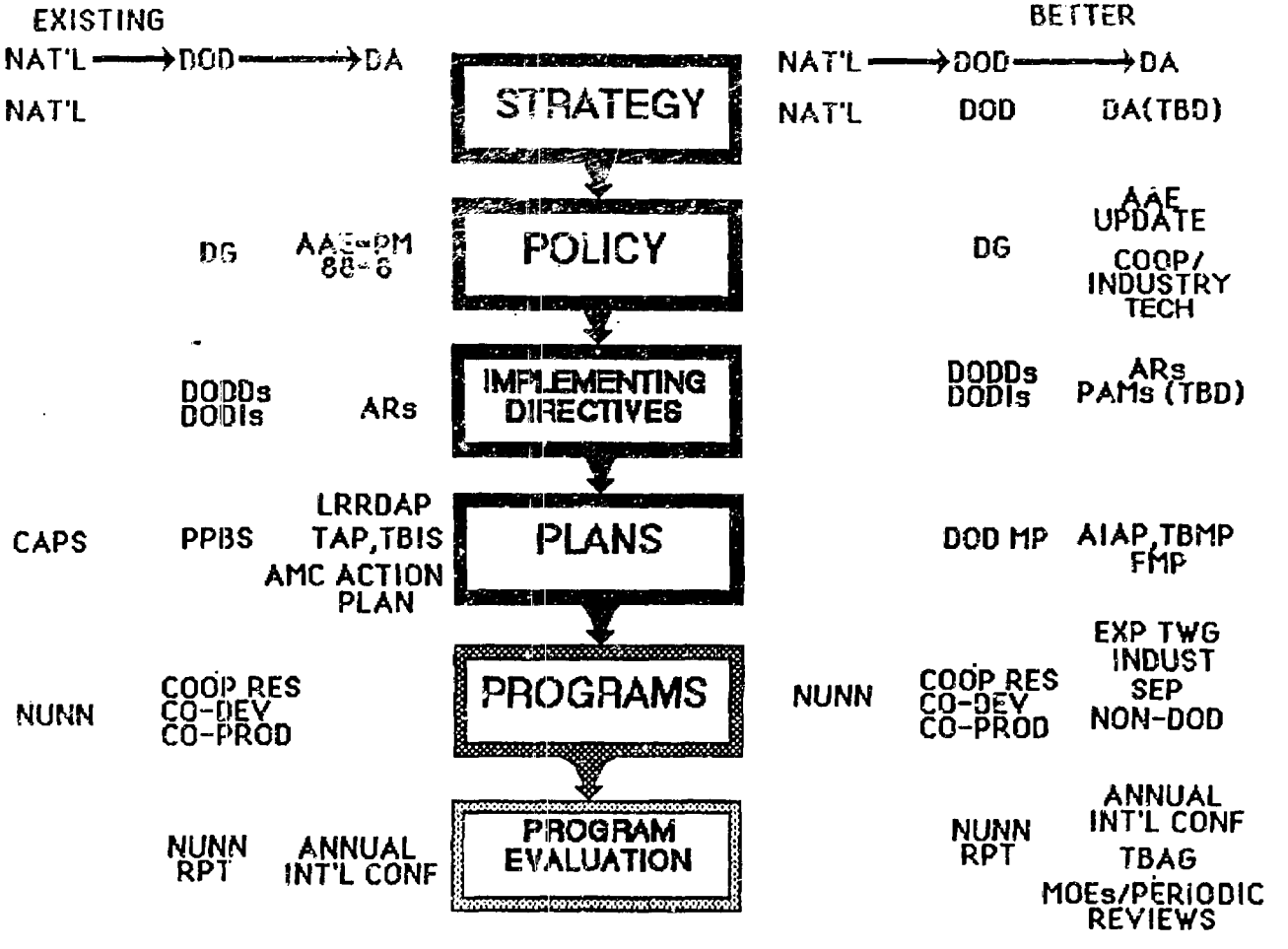
Relationship of Issues/Recommendations to Terms of Reference
(House of Quality for Army International Cooperation)

Terms of Reference \ Issues/Recommendations	Issue 1: Strengthen Policy & Imple.				Issue 2: Use Bi-Lateral Working Gp Concept				Issue 3: Enhance S&E Exchange Program				Issue 4: Exploit Global Tech Opportun.				Issue 5: Leverage Non-DOD Activities			Issue 6: Increase Industry Participation			
	Recommendations				Recommendations				Recommendations				Recommendations				Recommendations			Recommendations			
	1	2	3	4	1	2	3	4	1	2	3		1	2	3		1	2		1	2	3	
Examine Current Army Programs/ Means	M	M	S	M	M	M	M	M	S	S	S		S	S	M		W	M		M	S	M	
Evaluate U.S./ France WG as Prototype	W	W	M	W	S	S	S	S	M	W	W		M	M	M		O	W		O	O	M	
Assess Current Impact on Labs/ Centers (Include Nunn Opportun.)	W	W	M	W	M	M	M	M	S	S	S		M	S	M		W	O		M	M	M	
Consider Barriers & How to Mitigate	S	M	S	S	W	W	S	S	S	S	S		M	M	M		S	W		S	S	S	
Recommend Better Integ./Strat.for Int'l Coop	S	S	S	S	S	M	M	M	S	S	S		S	S	S		S	M		S	S	S	
Recommendation Priorities	1	2	3	4	1	2	4	3	1	2	3		1	2	3		1	2		3	1	2	
Issue Priorities	1				3				4				5				6			2			

S = Strong M = Medium W = Weak O = No Relationship

The second major objective of the study--to identify a better framework for more efficient leveraging of the Army international cooperative RDA--is related to the first key recommendation. An improved framework for Army International Cooperative RDA is presented:

INTERNATIONAL RDA FRAMEWORK



INTERNATIONAL RESEARCH, DEVELOPMENT AND ACQUISITION (RDA) FRAMEWORK

A framework for international RDA must be based on a top-down systems approach at national, DoD, and DA levels. It must begin with a strategy based on global/regional/ country-specific goals and objectives which can be formulated into a policy for implementation. Directives are used in the Defense Department to translate this policy into specific guidance for regulatory execution. Plans, programs, and evaluation are the appropriate vehicles for execution and assessment, and resource allocation is achieved through the Planning, Programming, and Budgeting System (PPBS). The integration of the international cooperation framework into the Army's recently formalized technology base and force modernization planning process will result in many synergistic benefits. One of the more important benefits will be the sharing of financial and personnel resources, which becomes increasingly important during an era of constrained budgets and streamlined organization structures.

The existing framework is deficient in many areas, starting with an undefined strategy at the DoD and DA levels. While policy formulation has been specified in Defense Guidance and AAE Policy Memorandum 88-8, its implementation has not been sufficiently identified in directives or plans, and commitment to its execution varies. While a significant level of international cooperative RDA programs exists and Army use of Nunn funding has increased, evaluation of their effectiveness is non-extant. In the existing framework, industry participation and partnership is minimal except in the execution of specific cooperative programs. Plus, there is little, if any, use, coupling, or leveraging of non-DoD and other DoD international cooperation initiatives.

As a result of this ASB study, six key recommendations were identified which could provide a better international RDA framework. The first recommendation recognizes the need for the Secretary of Army (SA) to obtain clarification on DoD strategy, so essential for the Army to develop its own strategy consistent with DoD. DoD has promised to issue an Armaments Cooperation Master Plan to provide guidance to the services, and the preparation of an Army International Activities Plan (AIAP) has been initiated, but there is little evidence of synchronization between and timeliness of these two independent efforts. Also, technology development and exchange efforts, both by government and industry, do not appear to be under active review by the organizations given these responsibilities. The recommendation to use bilateral Technology Working Groups (TWGs), where appropriate, and a more attractive Scientist and Engineer Exchange Program (SEEP) could help to alleviate this absence if OASA(RDA) provided direction to their use in evaluation of identified regional opportunities on a priority basis.

Two additional elements which can significantly enhance the framework are greater participation by industry and a more active Army involvement with non-DoD and other DoD activities. Industrial involvement in almost all phases is essential in view of asymmetries between the U.S. and many of the cooperating countries. These asymmetries include government and industry structure, acquisition practices, and data

rights ownership. Non-DoD international activities offer significant opportunities for Army participation. Together, these six key recommendations provide a better framework for a more effective integration of the Army's international cooperative RDA program.

In order for the framework to be a dynamic and viable structure, it must recognize and reflect the broader context in which it exists and functions. This broader context can be viewed as a set of overlapping spheres of influence, three of which are highlighted here. The first sphere of influence that must be recognized is that of the Department of Defense. The DoD is undergoing significant management and organizational reform as reflected in the National Security Review document, NSR-11. It is critical that all elements of the international RDA Framework are enacted in the most efficient way so that their enactment is consistent with two of the most important guidelines for Defense Management Reform. First, the planning, programming, and budgeting process and the system acquisition process must fully integrate considerations of the Army's international strategy within the decision-making framework--at each acquisition milestone and at every resource allocation decision point. As such, every plan and program must consider the costs and benefits associated with international opportunities, and fully integrate international technology contributions of our allies into the Army RDA program, when such integration is consistent with overall Army RDA strategy. Second, policies, regulations, procedures, personnel, and practices must be rationalized and streamlined so that all organizations and individuals can promptly, efficiently, and effectively exercise the full range of their authorities, consistent with their responsibilities and accountabilities, and thereby rapidly and effectively deploy Army strategies and enact Army policies. These two guidelines will enable the Army to develop a strong technology base.

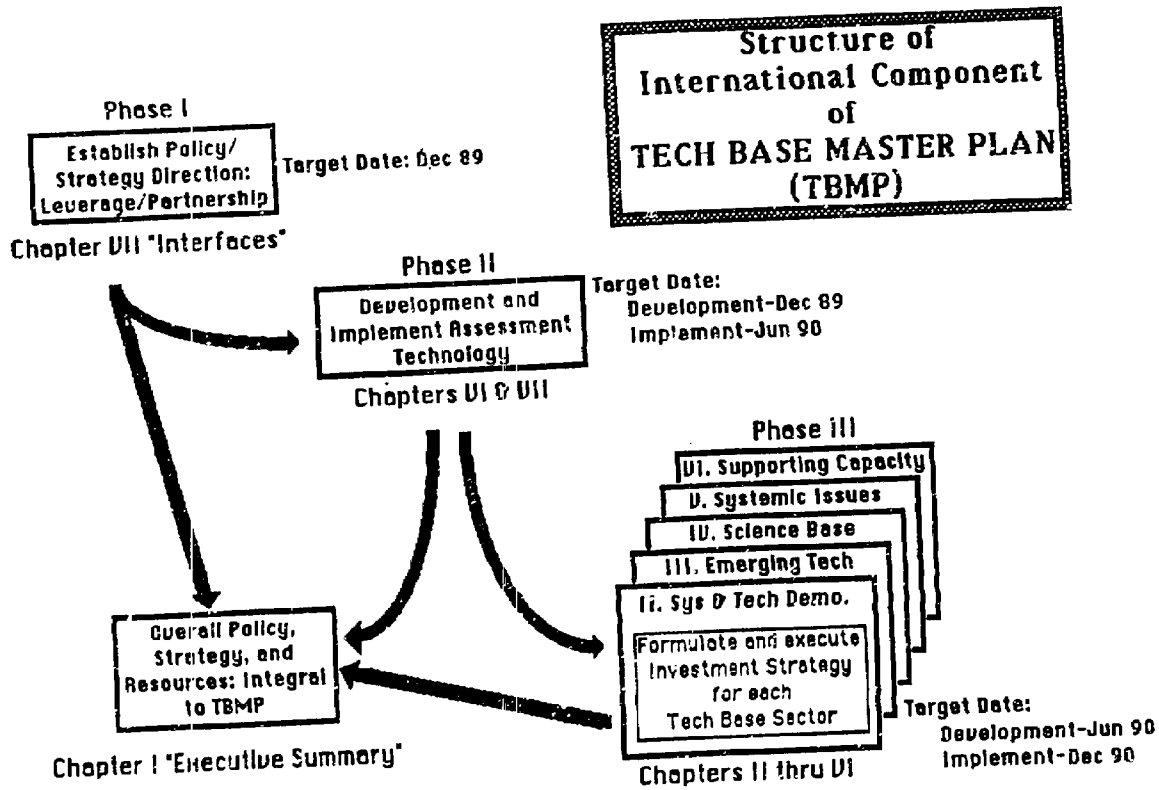
The second sphere of influence in the broader context in which the Army operates is that of industry. It must be recognized that a strong technology base must be coupled with a strong defense industrial base, if we are to maximize our warfighting capabilities and those of our allies. This coupling must occur throughout the life cycle of the technology by facilitating the cooperation and full involvement of industry beginning in the technology base and extending throughout all phases of the acquisition program. This life-cycle cooperation necessitates a long-term focus--decisions made today will significantly affect the modernization of our forces over the next 30 years. It also necessitates a near-term focus--actions must be taken with compelling urgency to meet key program schedules, satisfy critically important military requirements, and to take timely advantage of opportunity windows.

The third sphere of influence is that of our allies. The Army should develop explicit strategies for cooperation with each of our allies on a regional basis, considering our interests and the interests of each country in that region: in North America, to recognize our special partnership with Canada; in Europe, in the context of the current negotiations on structuring conventional forces; in the Middle East, to enhance the stability of this region; around the Pacific rim, to recognize the potential for technology partnerships; and in the Southern hemisphere, to be alert to the potential for strategic alliances. In

particular, the Army should work together with each ally who is willing to work with the U.S. to develop RDA strategies that will jointly leverage funding and technology and that are mutually beneficial and equitable. This study enumerates specific opportunities for cooperative technology development and force modernization; however, the enumeration should be viewed as the initial listing of opportunities; it should not delimit the horizon of yet to be discovered, heralded, and realized opportunities.

INTERNATIONAL COMPONENT OF THE TECHNOLOGY BASE MASTER PLAN

It is essential to include an international cooperation component into the Army's Technology Base Master Plan (TBMP) and force modernization plans if defense guidance and Army Acquisition Executive goals in international cooperation are to be achieved. The structure of the international component of the TBMP could be a three-phase effort, as illustrated. Phase I could be incorporation of updated strategy and policy with goals and guidelines for leverage and partnership. It could be included in the first revision of the TBMP scheduled for December 1989 and would properly fit in Chapter VII of the TBMP "Interfaces". Phase II and III would be implementation of this strategy and policy into technology base investment strategy (TBIS) and the heart of TBMP. A target date for inclusion in TBMP would be the second revision, scheduled for December 1990.



APPENDIX A

TERMS OF REFERENCE

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

6 DEC 1988

Mr. Gilbert F. Decker
Chairman, Army Science Board
Penn Central Federal Systems Company
1800 Diagonal Road
Suite 500
Alexandria, Virginia 22314-2840

Dear Mr. Decker:

You are requested to appoint a panel of 10-12 Army Science Board Members to conduct a Summer Study during 1989 on "International Cooperation and Data Exchange to Enhance the Army's Technology Base." The study should address, as a minimum, the Terms of Reference (TOR) described below; however, the panel should consider the TOR as guidelines and not be inhibited from considering other issues regarding international cooperation to enhance the Army's technology base that it deems as important.

I. Background

Many of the U.S. allies have independently developed powerful research and development enterprises which, in principle, provide a basis for productive intra-alliance cooperation in defense technology development and force modernization. In addition to joint development projects, these relationships should contribute to a mutual enhancement of the defense technology base and to the establishment of mechanisms for information exchange. There are, however, several internal and external barriers to bringing such cooperation into being, to encourage its growth, and to produce useful results.

The Army has undertaken a number of international programs and is now beginning in a comprehensive way to assess the potential value and contribution of intra-alliance technical cooperation.

The Army Science Board has been asked to look specifically at how to enhance the Army's technology base through international cooperation and data exchange programs. This may be the first in a series of several studies of the international role in the Army's research, development and acquisition system.

II. Terms of Reference

1. Examine the current technology base data exchange agreements, international working groups, scientist exchanges, liaison offices, overseas technical centers, and international cooperative research and development programs.

2. Evaluate as a prototype the Technology Working Group with France.

3. Assess the current impact on labs and centers of international involvement to include an evaluation of opportunities presented under the Nunn Amendment.

4. Consider barriers to technology base international cooperation and how to mitigate them to include (but not be limited to) special security arrangements such as blind proxy trusts established for foreign ownership of U.S. companies, Department of State and DOD policies on technology export/import restrictions, and other barriers.

5. Recommend how international technology can be better integrated in the Army Technology Base, strategies for international technology cooperation and its management, and how to bridge from U.S. Technology Base efforts to effective cooperative research and development.

The study is expected to require numerous briefings as well as visits to some field locations.

LTG Donald S. Pihl, Military Deputy to the Assistant Secretary of the Army (RDA), and LTG Jerry Max Bunyard, Deputy Commanding General for Research, Development and Acquisition will co-sponsor the study. The Cognizant Deputy will be MG Richard D. Beltson, Deputy for Technology and Assessment. The Senior Advisors will be Mr. George Singley, the Director of Army Research and Technology, OASA(RDA), Mr. Bryant R. Dunetz, Assistant Deputy for International Cooperation Programs, AMC, and Mr. Bruce Fonoroff, Director, Technology, Planning and Management, U.S. Army Laboratory Command. The Staff Assistant will be Mr. Fred Adler, Chief, International Research and Technology, U.S. Army Laboratory Command.

The Panel should begin its work immediately and conclude the effort at the 10-day summarization and report writing session scheduled for 16-27 July 1989 at the United States Military Academy, West Point, New York.

It is not expected that your inquiry will go into any "particular matters" within the meaning of Section 208, Title 18, of the United States Code.

Sincerely,

J. R. Sculley
Assistant Secretary of the Army
(Research, Development and Acquisition)

APPENDIX B

TITLES AND AFFILIATIONS OF PANEL MEMBERS

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1989 ARMY SCIENCE BOARD SUMMER STUDY
ON
INTERNATIONAL COOPERATION AND DATA EXCHANGE TO
ENHANCE THE ARMY'S TECHNOLOGY BASE

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Mr. Steven G. Kevlin
U.S. Army Materiel Command

OTHER

Mr. Aaron L. Mahr
Acting Chief, Office for International Cooperative Programs
U.S. Army Materiel Command

APPENDIX C

GLOSSARY

GLOSSARY

AAE.....Army Acquisition Executive

ADPA.....American Defense Preparedness Association

AIAP.....Army International Activities Plan

AMC.....Army Materiel Command

AR.....Army Regulation

ARI.....Army Research Institute

ARO.....Army Research Office

ASA(RDA).....Assistant Secretary of the Army for Research, Development and Acquisition

ASB.....Army Science Board

ASBREM.....Armed Services Biomedical Research, Evaluation and Management

B.....Billion

BRL.....Ballistics Research Laboratory

CAPS.....Conventional Armaments Planning System

CBW.....Chemical and Biological Warfare

CFE.....Conventional Force Enhancement

COE.....Corps of Engineers

CSA.....Chief of Staff, Army

DA.....Department of the Army

DEA.....Data Exchange Agreement

DG.....Defense Guidance

DoD.....Department of Defense

DoDD.....Department of Defense Directive

DoDI.....Department of Defense Instruction

DOE.....Department of Energy

EEC.....European Economic Community

EPA.....Environmental Protection Agency

ERO.....European Research Office

FY.....Fiscal Year

GO.....General Officer

IPA.....Intergovernmental Personnel Agreement

IPR.....Intellectual Property Rights

LABCOM.....U.S. Army Laboratory Command

LRRDAP.....Long-Range Research, Development and Acquisition Plan

MACOM.....Major Command

MOE.....Measures of Effectiveness

MRDC.....Medical Research & Development Command

MRDT&E.....Medical Research, Development, Test and Evaluation

MOU.....Memorandum of Understanding

NASA.....National Aeronautics and Space Administration

NATO.....North Atlantic Treaty Organization

NIST.....National Institute of Standards and Technology

NOSC.....Naval Oceanographic Systems Center

NSF.....National Science Foundation

NSR-11.....National Security Review 11

OCONUS.....Outside Continental United States

OASA(RDA).....Office, Assistant Secretary of Army (Research, Development and Acquisition)

OSD.....Office of the Secretary of Defense

OTA.....Office of Technology Assessment

PCS.....Permanent Change of Station

POM.....Program Objective Memorandum

PPBS.....Planning, Programming and Budgeting System

R&D.....Research and Development

RDA.....Research, Development and Acquisition

RDT&E.....Research, Development, Test and Evaluation

ROI.....Return on Investment

ROTC.....Reserve Officer Training Corps

S&E.....Scientist and Engineer

S&T.....Science and Technology

SA.....Secretary of the Army

SEEP.....Scientist and Engineer Exchange Program

SES.....Senior Executive Service

SOP.....Standard Operating Procedure

TBAG.....Technology Base Advisory Group

TBIS.....Technology Base Investment Strategy

TBMP.....Technology Base Master Plan

TOR.....Terms of Reference

TPO.....Technical Project Officer

TWG.....Technology Working Group

URI.....University Research Initiative

USAMRDC.....U.S. Army Medical Research and Development Command

WG.....Working Group

APPENDIX D

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